

The uncontrolled development of industry and the rapid progress of civilization is a serious threat to the environment. Hence, nowadays a very important issue is the environment protection. One of its aspects is the utilization of gaseous pollutants emitted into the atmosphere. Flue gas streams produced in industrial processes have diverse qualitative and quantitative composition and also vary in terms of physicochemical properties. Therefore, there is no single universal method for purification of gases, in order to maintain the level of air pollutants below specified, do not endanger the health and lives of people, the values used in a series of processes to reduce emissions of pollutants in the waste gas streams. Among them, using chimney filters should be mentioned. The generally speaking, the action of such filters can rely on adsorption phenomena or molecular sieve. Both of these properties are characterized by mineral silicates, known as zeolites.

Membrane processes belong to a large group of techniques for separating both the gaseous and liquids components. Membrane systems are used for separation of gases in the chemical and petrochemical industries. Depending on the properties, they can be used for the separation of micro- and nanometric particles. Very important materials used for such processes are the membranes prepared from zeolites supported on various substrates. The channels present in the zeolite structure have particle sizes and can be used for the construction of membranes. Zeolites often are called "molecular sieves" because it can separate different particles from the mixture as in everyday life, various substances are separated using sieves. Zeolite molecular sieves can be used to remove ammonia and water vapor from an inert gas as well as CO_2 , SO_2 , H_2S or $\text{C}_2\text{H}_5\text{OH}$. However, the zeolites are a very large group of structures. It is important to control the method for the preparation of membranes for the formed well-defined, the most anticipated zeolites.

Membrane separation processes are carried out in so-called membrane modules. Most zeolite layers are obtained on flat or tube media and made of porous sintered or stainless steel. Membrane support must meet certain requirements as adequate mechanical strength as well as chemical and thermal resistances. Supports prepared from aluminosilicate materials obtained by the so-called geopolymerization raise big hope. Such materials are proposed in this project. At the same time, with suitable selection of the raw materials, it is possible to obtain a zeolite phase in the volume of the geopolymeric substrates. The resulting membrane filters will be characterized by high chemical resistance, which gives the possibility to use it wherever is a need to use very aggressive solvents, such as organic solvents or concentrated acids.

Proper use of membranes supported on geopolymers is associated with an indication of their properties. This, in turn, is possible only on the basis of detailed structural studies, which very often are supported by complex calculations carried out on high-power computers. All these activities have also been planned in this project.